TANDY LAPTOP COMPUTING FEBRUARY 1990 -VOL. 7, NO. 2

TERRY KEPNER'S

portable 100

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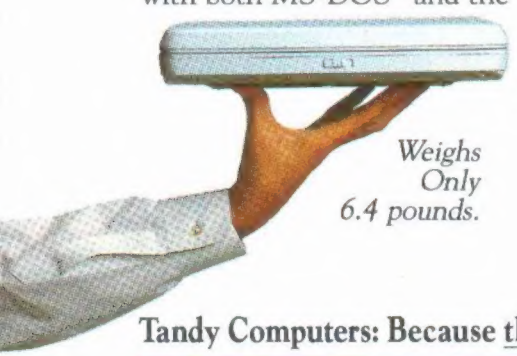

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VOL. 7, NO. 2
February 1990

ON THE COVER:
Yes, you, too, can have a mouse on your computer, just like the $3,000 big boys!

Photo by Dave Klein.

C9 Mouse courtesy of Logitech Inc. (available through Tandy Express Order System).

Tandy 102

A BETTER MOUSE TRAP 8
by James Yi
Drive your cat crazy—add a mouse to your Model 100/102/200!

Tandy 200

LILITH: A COMMERCIAL DATA ENCRYPTION PROGRAM 14
by Bob Scott
Keep your files on a For-Your-Eyes-Only basis. (Not even 007 can get at them!)

THE FALCON, THE FLIGHTSTICK, AND THE TOP FLIGHT GAME PORT 16
by Bob Liddil
Add a game port and a first-class joystick to your 1400!

Tandy 600

INSIDE THE TANDY 600 (PART 3 OF 3 PARTS) 18
by Stevie A. Stark
A guide to the insides of the Tandy 600 and other computers!

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Tandy 1400LT

ROM WITH A VIEW

ROM WITH A VIEW is where I spout off on some editorial topic, right? Well ... maybe. Seems the special announcements keep eating my spouting space. Not much I can do about it until we get more space. Meantime, just pretend I've spouted something profound, and we'll move on ...

Bigger P100: Your next *P100* will be four pages thicker. Two pages' worth of new ads has yielded two more pages for articles. A little more for your money.

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Reminder: Be sure to put your address on Reader Service Cards you send in. Without it, advertisers can't send you the requested info.

UltraCard Lives: Ultrasoft has delivered the first batch of UltraCard memory expansions. More should ship by the time you read this. Can't wait to test one and tell you how it works!

WP-2 Dynashield: My Dynashield has protected my Model 100 from countless disasters. The WP-2 should have one too, don't you think? Well, Dynashield has developed it! Made of polypropylene, its black wrinkle finish matches the WP-2. BUT—Dynashield wants to gauge the demand before spending big bucks on production. So, if you want a WP-2 Dynashield on the market, be sure to let 'em know!

WP-2 RAM: MicroMime now offers a 128K WP-2 RAM chip for for $89.00. See their classified ad.

WP-2 *Portcomm*: Club 100 has developed *WP2DOS*, which lets your WP-2 use your PC as a disk drive. Nice work, Club 100! And it gets better ...

FLASH!!! Effective immediately, Club 100 has taken over sales and support of Traveling Software's notebook computer products. Great prices, too! (See their new ad.) One bummer—*Sardine* is history. They can't acquire rights for the *Random House Dictionary* used by *Sardine*. As for *TS-DOS* ROM version and *MacDOS*, stay tuned!

Half Power: Bill Brandon was so inundated with "opportunities" at work, he had to hold off on this month's FULL POWER column. (We can empathize, Bill!)

Hidden Products: We keep nagging PCSG to advertise their other products. One example is *TUTOR+*, a nifty customizable typing tutor. (I learned Dvorak typing with it.) Want a custom *Super ROM*? PCSG can often add a desired program by removing another. For example, if you want a *Super ROM* containing their *DISK+* laptop/desktop file transfer software, and you're willing to forgo the *Thought* outliner, they can make one for you. There's more, but you'll have to contact them to find out what. While you're at it, bug 'em to run that ad! *P100* will get even fatter, you'll get more articles and products, and they'll get more sales. Seems fair to me.

Banks, Too: You thought American Cryptronics only carried RAM chips? Not so! They have expansion RAM banks, too. Their 96K unit in one of my M100's, gives me four 32K banks (128K total RAM) and fits completely inside the 100.

So Simple: Sigea's *X-TEL* Xmodem telcom software is excellent for the Model 100/200, but until I had an MS-DOS computer, I couldn't try their *Telecommuter*. Well, guess what's on my 1400 HD now? They make the M100 and PC a perfect team, with easy file transfer. Even when traveling, my M100 can call home and swap files with the 1400. *Telecommuter*'s word processor works just like *TEXT* on the M100—no need to learn new commands. *X-TEL* and *Telecommuter* are great by themselves. Together, you've got real synergy. See NEW PRODUCTS for more info.

Well, that's the gotta-mentions for this month. Shucks, folks, I'm spoutless!

-Nuge

Toolbox

Manuscripts were typed into Microsoft Word 3.0 on a Tandy 1400 HD, where they were edited, spell-checked, and had basic format instructions inserted. From there they were loaded into a Tandy 4000 (80386 CPU, Tandy EGA Monitor, Tandy LP-1000 LaserPrinter) desktop computer and placed into Aldus' IBM PageMaker 3.01 Once there, design decisions on photo, figure, and listing sizes and placements were made. Here, pull quotes are placed, headlines, intros, and bylines are sized and positioned, and advertisements positioned.

Normally, the Tandy LP-1000 is capable of emulating only a Hewlett Packard Laser Printer Plus. But with the addition of the Destiny Technology Corporation (300 Montague Expressway, Suite 150, Milpitas, CA 95035. (408) 262-9400) PageStyler 4.5MB kit, the LP-1000 is turned into a fully-compatible PostScript printer, with all 35 native fonts that are found in the Apple LaserWriter Plus printer. The Destiny PageStyler is available through the Tandy Express Order Hardware system.

Page previews were output from the Laserprinter. When everyone was satisfied with the appearance, final pages were output and artwork and lineart ads were positioned. The finished magazine was then delivered to the printer, who printed it, labeled it, and mailed it to you.

TERRY KEPNER'S **portable 100**

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NASA WOULD BE PROUD!

Enclosed is a clipping from the January 4, 1990, *Ann Arbor News*, detailing the use of the Tandy 102 by the Sheriff's Department in Ottawa County, Michigan. I know the same situation has occurred elsewhere, but it's nice to know that the trusty Tandy 102 is still being used by various agencies as a low-cost way to increase productivity.

I hope to have an article for you soon, telling how my fellow club members (Huron Valley Rocket Society) and I use the 102 to gather data from payloads flown in rockets. The payload is a MC6805 computer that stores data from various sensors (spin rate, temperature, acceleration, battery voltage, and other parameters) during the flight of the rocket. The data is downloaded to the 102 upon retrieval of the payload, and a custom program graphs the data points. I hope to have a full article ready sometime within the next few months—after we've got more flights in. Keep up the good work with *Portable 100*!

Mark F. O'Brien
Ann Arbor, MI

Thanks for the clipping, Mark. Our favorite little lapwarmers continue to become the machine of choice for many government, business, and scientific groups.

We're eagerly awaiting your article! Why not include some photos of the members, the rockets, and of course, the 102's in action? It might "launch" a few new rocketeers into the hobby.

-MN

BUSCH LEAGUER

Please consider a collection of all the old letters to the editor, forums, and help columns, or an edited compilation of them, as a publication for sale.

Also, please persuade David Busch to collect his works in a book for sale. I'd like to have them all, but my budget does have its limits.

Benn E. Clouser
Wilmington, DE

Benn, I just spoke to David Busch, whose columns I, too, have always enjoyed. He's interested, so cross your fingers, and we'll see what develops!

Compiling Portable 100 *letters, columns, etc., is a major undertaking. We've been wanting to do it, though we're not properly equipped just now. Hang in there—we may pull it off eventually.*

-MN

A DIFFERENT OPINION

I've just read "A Printer for Our Times," by Michael Daigle, in the December '89 issue, regarding the new Diconix 150 Plus printer.

I believe he has seriously misjudged the performance of this printer when using plain paper, as no mention is made of also switching to the plain paper ink jet cartridge that would also be required in this use. If he did not make this switch, then I think the voluminous negative comments are completely unwarranted.

We have a couple of the first versions of this printer and have enjoyed their use in the office as well as in planes, trains, and hotel rooms. Their performance over two years has been excellent, and so far, no service has been required.

Something is off-balance here.

We also benefit in supporting these printers by sharing ink jet paper and cartridges that are otherwise also used for out Hewlett Packard ink jet printers, which are our standard for internal desktop and external customer installations. Despite the higher cost of ink jet paper, the quiet performance, quality of the finished page, small footprint, and lower usage compared to operations or accounting tasks rationalize their benefits.

The reviewer's problems with margins are probably in reference to the left margin. The compact design of these printers is partially made possible by parking the print head within the page boundary. Accordingly, a zero left margin is automatically one inch in from the left edge of the page, which allows a maximum of 90 characters per inch. This zero margin is easy to set within Write ROM (included in Super ROM) on the 100/102/200 machines and certainly on any competent word processor for the PC class and extensions. This should not be a barrier for an experienced computer user.

I also do not understand the battery charge problems. The reviewer noted that a fourteen-hour charge yielded one hour of operation. One hour of operation is probably 60 pages of production, which seems an extraordinary amount for on-the-road production. In my experience, a "travel printer" is needed not for quantity, but for responsiveness to a developing situation. So far, I would think maybe ten pages is the maximum for any one trip. Ignoring this rationalization, our older versions of this printer are rated at 500 pages per charge. I would also think that heavy travel production implies a fixed base, which in turn would justify carrying the power unit. Something is off-balance here.

In our experience, the Diconix machines are excellent performers. The author's bashing seems way out of line with their actual performance when used by a careful user, and an inaccurate basis for attempts at humor.

E.H. Mackay
ATM Service Corporation
San Diego, CA

Michael Daigle responds:

Mr. Mackay—You raise some good points. I was not aware that there was a "plain paper" ink cartridge available for the Diconix. If that option was mentioned in the manual, I missed it. I'm sure that would have made at least some difference in my review.

You say of your printers that "their performance ... has been excellent" and that you can "rationalize their benefits." Good. I think it's appropriate that you own and use a tool so well suited to your needs. Like beauty, "quality" and "usefulness" are in

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the eye of the beholder.

If you use the Diconix for letters and memos, and its output is acceptable, that's great. But I'm a writer. My output falls under the critical eye of editors who won't even look at a manuscript that looks less than perfect. My output must compete with IBM Selectrics, HP Laserjets, and daisy-wheel printers. And in that realm, the Diconix just doesn't quite cut it.

Was my review biased and sarcastic? Absolutely. I never pretended otherwise. That's me. But be fair—read the column again, and look at my conclusions. Overall, did I really "bash" the Diconix?

I guess that, too, is in the eye of the beholder.

In any case, thanks for writing—and thanks for reading.

INDIVIDUALIZED SERVICE

Thanks to Lee Warren for his kind words about one of my products, *CRDFIL.ROM*, and the service he received from my company (I/O, Dec. '89).

I believe that all vendors would like to think they can offer that level of service. In most cases, though, you aren't dealing with the man at the top, but someone who is paid to provide customer support. And often, especially if the business is a success, there isn't enough time in the day to provide that level of service to each customer, no matter how much the man at the top would like it to happen.

Quite often the customer service people (and we don't want to denigrate the fine service they DO provide) just can't provide the individual attention and service that the original author or man at the top can. Whereas an individual can do whatever is necessary to make the sale, a company can't afford to pay someone to make major revisions in a program to suit an individual customer. It's just not cost efficient; the company loses more money than they make in the sale.

So, thank God for the individuals still in the business who can, and will, provide that level of service. When you find 'em, please support 'em.

Tony Anderson
T.A.F.T.
Reno, NV

PHD FEEDBACK

Mike, I enjoyed your review of the Weltec PHD disk drive in the December issue. My experience with the unit, unlike yours, wasn't all roses. Here's a brief rundown of my experiences.

The boot/driver disk was an unformatted floppy. Technical support didn't believe that I was sophisticated enough to tell the difference between an unformatted disk and one with information on it. Tech support seemed to finally warm up to the fact that I wasn't just any dumb user. They were helpful and courteous from then on. Finally they sent me a new floppy which allowed me to boot up the system.

I received a preliminary copy of the user's manual which is worse than useless. It's misleading in some sections. I'm still waiting for the final manual.

The PHD refuses to recognize the internal hard disk of the NEC Multispeed HD laptop. The driver insists on installing itself as drive C, thus denying access to the internal drive. The PHD, however, worked fine with a floppy-only version of the Multispeed and two desktop machines that I tried.

The "feel" of file transfer does, as you say, seem very speedy. Most of the files I tend to deal with are relatively small. Ever the curious, I did some stopwatch tests on several large files. Interestingly, the transfer rates are asymmetrical (see Figure 1). The transfers to/from the PC were from a RAMdisk to avoid any PC disk transfer overhead. I ran the tests on a 10MHz XT-clone.

File Transfer Statistics

File Size	PHD—>PC	PC—>PHD	Ratio
13,312	2 sec	7 sec	3.5 : 1
121,856	16 sec	51 sec	3.2 : 1

Figure 1. Interesting asymmetry: The PHD seems to load files three times as fast as it saves them.

I had difficulty accessing several large files. The good news is that the Norton Utilities recognized the PHD as a disk drive that it could deal with. The bad news is that the *DT* (disk test) program found a file allocation table (FAT) error which was correctable. The files were corrupted although for the most part salvageable.

Ever the optimist, I hooked up the PHD to my floppy-only DOS laptop to help speed development of a program I am writing. It turns out that the application uses the serial port, the same one that the PHD needs. Oh, well, you know what they say about the best laid plans and all that ...

The unit is big and heavy. The power cord on the transformer is the shortest I've seen (two feet). I'm not traveling with this baby. The PHD plus transformer weighs more than my laptop. For about the same money I can get a hard disk version of my laptop and save a few back and arm aches.

Still, in spite of the difficulties I've had, the unit works quickly and well. The reliability factor still makes me nervous after the FAT incident. I intend to keep and use the unit. Its primary function will be to collect data at a remote laboratory. I can then carry the unit back to my desk for analysis. This is what I bought the unit for.

My final conclusion is hooray for Weltec! This is the sort of innovative product that endears itself to people, because it magnifies the capability of their systems if they put it to the right use. Despite a bumpy start it works for me.

Stan Wong
Santa Ana, CA

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The Wizard Of DOS Part 1

Twilight on a blustery winter afternoon. The storm, born over the Pacific, had finally reached the city. The wind was blowing so hard that the rain was falling sideways. Being a storm freak, I was sitting out on my covered front porch, a steaming mug of coffee in hand, blanket over my shoulders, watching the clouds roll in. Once in a while I'd catch the rare electric flash of lightning, and I'd close my eyes, smile, and wait for the inevitable rumble of the thunder.

I noticed my coffee was nearly gone. The mug held one last inch that was almost as cold as the rain itself, so I got up and went to the railing to toss the dregs overboard. That's when the accident happened.

My foot, which is used to spending so much of its free time in my mouth, got caught up in the blanket just as I was leaning over the railing. Over I went. On the way down, I remember calmly and clearly thinking "AAAIIIIEEEEEEEY YYYY!!!!!"

My porch is only a few feet above ground level, but I seemed to fall forever as the storm raged and the winds tossed me around like a dirty sock in The Washing Machine of the Gods.

Finally, I landed in a perfect sitting position on an armless secretarial swivel chair. The sounds of the storm had abruptly stopped and through the deafening silence that followed I was able to pick up a soft but terrifying sound that turned my blood to ice water.

Muzak.

Heart pounding, short of breath, I found questions racing through my mind. What was going on? Where was I? How did I get here? How many angels could dance on the head of a pin? Speaking of pinheads, why did Bush choose Quayle as a running mate?

I had to get a grip on myself. I swiveled the chair a full 360 degrees as I took stock of my surroundings. I was in a small, windowless office. There was a desk, a filing cabinet, and a credenza, all bare-surfaced. A large picture on the wall showed a huge, impossibly tall green skyscraper, its upper heights disappearing into the clouds. Carved in the stone facade above the gigantic entrance were the words EMERALD ENTERPRISES, INC. Some inner instinct told me that this was the very building I was now in.

As I stood up on wobbly legs, I noticed a strange sensation in my feet. Looking down, I discovered to my horror that although I was still wearing my customary jeans and sweatshirt, my feet were clad in a pair of high-gloss, wingtip Florsheim dress shoes! I felt my mind start to melt down and run out my ears.

I felt my mind start to melt down and run out my ears.

I realized I was wearing a backpack. Slinging it off and looking into the main compartment, I discovered I wasn't alone—my faithful Model 102 was there with me! I pulled it out into the light and saw something strange; in the upper right-hand corner, instead of the familiar Tandy 102 Portable Computer name plaque, there was a plaque that read Model Tote-02. Before I could ponder the significance of that, the door to my office flew open with a bang.

A small guy that looked like a short, ugly version of Danny DeVito ran inside. "Has he been here yet?" he asked in a panicky voice, looking around the room like a cat looking for dobermans on angel dust and steroids.

"Who?" I asked.

"Who do you think?" he demanded. "Mr. Reemer—you know, the head of the Department of Corporate Conformity, that's who!"

"I haven't seen anybody else except you," I said. He was sweating bullets. "What's wrong, anyway?"

"What's wrong?" he echoed, incredulous. "What's WRONG? Look at my tie!"

I did. It was blue. "Yeah?"

"It's BLUE!" he shrieked. "Today's a red tie day and I forgot. If Reemer sees me, he'll tell Personnel that I'm not conforming to Corporate Standards, and I'll be fired on the spot!"

I found that a little hard to believe. "You mean you'd be fired just for wearing the wrong tie? That's ridiculous. What possible difference could it make?"

"It doesn't *matter*—the slightest deviation from approved corporate standards is grounds for termination, and Reemer reports any violation he sees. Why do you think he's called the Wicked Snitch in a Vest?"

I needed a drink. Or a tranquilizer. Or a lobotomy. Or—

"*Eeekkk,*" the little guy shrieked, pointing at my M102. "What's THAT?"

"It's my computer," I answered.

He looked at it with shock, then looked at me as if I had announced that I wanted to be just like Charles Manson when I grew up. "Hey, you're new around here, aren't you?"

"You could say that," I admitted.

"Well, you'd better get rid of that thing before Reemer sees it, or you're history." He looked at it again like he thought it might jump out of my hand and attack him.

"Relax," I told him. "It's just a Tote-02. It won't bite you." Why did all this seem familiar in some weird, twisted way? I needed some help, and this guy

Portable 100 BACK ISSUES

With over 60 issues, and hundreds of articles, *Portable 100* is THE source for information, programs, and applications for your Tandy Portable Computer. But how do you find what you need among all those issues? The answer is the **updated** *Portable 100 Article Index*. Covering every issue from September 1983 to the combined summer 1989 issue, the index is designed to make it simple for you to find what you need. And at a cost of only $9.00 (postage and handling included), you should buy one today! If you have last year's index, don't despair. Update your index by adding our special 1988-1989 Update Index. It's a bargain at just $4 (P&H included).

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April		OUT					
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June		OUT					
July		OUT		OUT		combined July/August	combined July/August & Sept. (Summer 1989)
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was my only option so far. "Who are you?" I asked.

"I'm N. A. Countit." He held out a small, sweaty hand. We shook. "I work in the Spreadsheet Department. Me and the other guys are number crunchers. Around here, we're called the Crunchkins."

I think I passed out.

* * *

When I came to, the scene had shifted in a dreamlike way. I was running down an endless corridor. When I tried to remember why, it came back in a flood: Reemer and his evil hoard of simpering Yes Men were prowling the halls of Emerald Enterprises, hunting me down. Reemer was trying to force a Toshiba laptop computer on me—probably a 5200, a 20-pound, AC-only ball and chain that would keep me here forever. Sometimes I'd hear his voice floating menacingly close from a nearby corridor, threatening "I'll get you, my friend—and your little Tote-02!"

Every once in a while I'd cross the path of a Crunchkin, who'd take one look at my clothes and my computer and turn the same shade of green as Tammy Faye Bakker's brain.

Finally, as I was about to collapse, I heard a "Psssssttt!" I looked around and saw N. A. Countit standing in an office doorway, frantically motioning me inside.

"Hurry," he hissed. "There's not much time!"

Once inside, I sat on the edge of a desk and tried to catch my breath.

"You gotta get out of here," the Crunchkin said. "You're being here is disrupting the entire flow of things. If the workers fall behind, we may never catch up. We'd lose vacation time, sick days, who knows what else. Heads will start to roll if you stick around!"

"Look, I want to get out of here myself, but it's a little hard considering I don't know how I got here in the first place." I went on to tell him in brief sentences how I came to find myself in Emerald Enterprises.

When I was done, he just nodded his head slowly. "Right ... yeah ... big storm blew you here. Sure. Well, look, I gotta go now." He began edging towards the door, wringing his little hands together, smiling with the nervous sincerity of someone telling Mike Wallace that he has no idea how that $100,000 got into *his* savings account. "Makes sense to me. Those big storms are ... big. Yeah. So. I'll see you arou—"

I grabbed him. "Look, I don't know what all this is about, but I'm tired of running around. I want to talk to whoever's in charge of this place. I need to find a way out."

And behind us, Reemer and his men pushed their way into the little room.

Reemer was tall, thin, and way too slick. He looked just like the kind of corporate hatchetman David Letterman would refer to as a weasel in a three-piece suit.

"Oh, you can't leave just yet, my friend," Reemer hissed. "I've got plans for you. *Big* plans." Turning to his men, he said, "Bring the new one along—and his *blue*-tied accomplice, too!"

N.A. gave a terrified little moan as we were dragged from the room.

To be continued ...

by Michael Daigle

COMPATIBILITY: Tandy 100/102 and Tandy 200

A Better Mouse Trap

Now you can add a mouse to your applications.

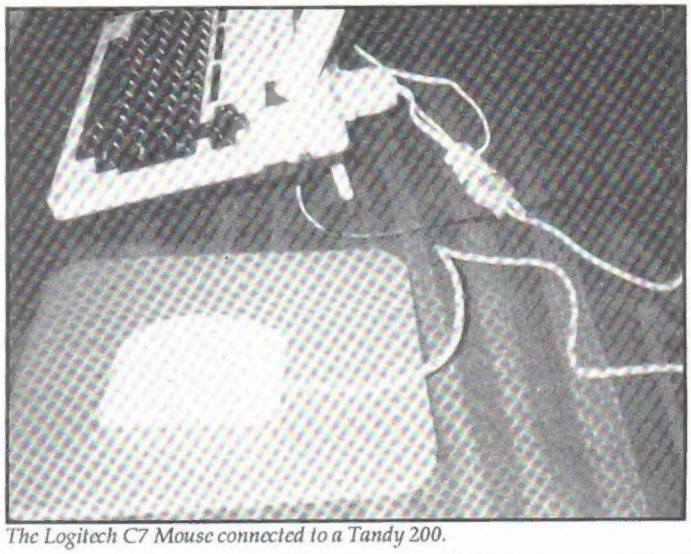
by James Yi

One day I got curious and decided to see if a mouse I was using on my PC could also work on my Tandy 200. Why not, I thought, since the mouse was designed to hook up to a standard RS-232C serial port, which came built into my portable. So I unplugged the mouse from the serial port of the PC, plugged it onto my Tandy 200's serial port, and started to tinker with it in an attempt to discover how this device was controlled. The result was successful.

If you want to duplicate my efforts, you'll need to enhance your hardware to assimilate the mouse to the portable's environment. Fortunately you don't need to modify the computer or the mouse, but make a special cable that interconnects the mouse, the serial port, and the bar code reader (BCR) port.

For most computers, serial rodents today do not require a separate power supply because their low power consumption makes it possible to draw power from the signal pins of the standard serial port, which has a voltage swing of 12 volts. But it turns out that the signals on the 100/102/200 serial port are weaker, about 5 volts, and thus not sufficient to power a serial mouse. So a mouse needs to be powered separately. Fortunately, the full 12 volts is not necessary, and the bar code reader port's 5-volt supply is sufficient. The cable you'll make reroutes the mouse's power supply connection, normally to the RS-232 port signal pins, connecting the mouse to the BCR port's power supply pins instead.

The mouse I originally tried was the Logitech C7. Although the C7 has been discontinued, the C9, the new version, is almost completely compatible with the C7. The only noticeable difference is that the C9, at 320 dots per inch (dpi), is more sensitive than the C7, at 200 dpi.



The Logitech C7 Mouse connected to a Tandy 200.

The C7 and C9 both interface through RS-232 serial ports. Other mice that you can plug into the serial port may work, but their control language may be different. Thus, the test program in this article, or any software written specifically for the Logitech C7/C9, may not work with them. The Logitech C9 is

```
10 '************************
20 '* Mouse tester for 100 *
30 '************************
40 CLEAR 256
50 DEFINT A-Z
60 GOSUB 9200:'Load machine language mou
se driver
70 DM=MD:AM=MD+3:GM=MD+6:SM=MD+9:'Call a
ddresses into the mouse driver
80 XM=40:YM=7:'X and Y maximum ranges
90 X=19:Y=5:'Initial X,Y coordinate
100 SC=8:'Mouse-to-screen ratio.  Change
 it to your liking.
110 GOSUB 9100:'Set max ranges and initi
al coordinate
120 PX=X:PY=Y:'Reset previous X,Y
130 GOSUB 500:'Draw mouse on the screen
150 CALL AM:'Activate serial port
190 '--- Main Loop ---
200 IF B THEN S=145 ELSE S=144:'Draw dif
ferent cursor according to button positi
on
210 PRINT@PX+PY*40,CHR$(S);:'Draw cursor
 where mouse is pointing at
220 GOSUB 9000:'Get new button position
and coordinate
230 IF (X<>PX)OR(Y<>PY) THEN GOSUB 700:'
Did the mouse move?
240 IF B<>PB THEN GOSUB 300:'Was any but
tons pressed/released?
250 IF B=0 THEN 200:'No buttons pressed
260 IF (Y=YM-1)AND(X>34) THEN 290:'Quit
```

Continued

Listing 1. Use this program to operate a mouse with your Model 100/102 or 200.

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Circle 17 on reader service card.

available in computer hardware stores, or you can order it by mail. Many computer magazines carry ads for the Logitech C9 mouse. Be sure to get the serial version.

This project requires no modification to the computer or the mouse. You need only build a special cable that connects the mouse to both the serial port and the BCR port. Soldering is required. Refer to the wiring diagram in Figure 1 to construct the cable.

Continued on page 12.

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Circle 137 on reader service card.


```
28Ø GOTO 2ØØ:'Loop
29Ø CALL DM:'Deactivate serial port
295 END
3ØØ '=== Light up buttons on screen ===
31Ø R=3
32Ø S=32:IF BAND4 THEN S=239
33Ø C=16:GOSUB 6ØØ
34Ø S=32:IF BAND2 THEN S=239
35Ø C=19:GOSUB 6ØØ
36Ø S=32:IF BAND1 THEN S=239
37Ø C=22:GOSUB 6ØØ
38Ø PB=B:RETURN
5ØØ '=== Draw mouse on the screen ===
51Ø SCREEN Ø,Ø:CLS:DIM S(YM*4Ø)
515 FOR L=Ø TO YM*4Ø-1:S(L)=32:NEXT
52Ø RESTORE 56Ø:R=Ø
53Ø C=14
535 READ S:IF S>Ø THEN GOSUB 6ØØ:C=C+1:G
OTO 535
54Ø R=R+1:IF R<7 THEN 53Ø
55Ø R=YM-1:S$="Quit":FOR L=1TO4:C=L+34:S
=ASC(MID$(S$,L,1)):GOSUB 6ØØ:NEXT
555 RETURN
56Ø DATA 32,32,32,32,32,245,Ø
565 DATA 24Ø,241,241,241,241,248,241,241
,241,241,242,Ø
57Ø DATA 245,24Ø,241,242,24Ø,241,242,24Ø
,241,242,245,Ø
575 DATA 245,245,32,245,245,32,245,245,3
2,245,245,Ø
58Ø DATA 245,246,241,247,246,241,247,246
,241,247,245,Ø
585 DATA 245,32,32,32,32,32,32,32,32,32,
245,Ø
59Ø DATA 245,32,32,32,32,32,32,32,32,32,
245,Ø
6ØØ '*** Draw a character on screen ***
61Ø S(C+R*4Ø)=S:PRINT@C+R*4Ø,CHR$(S);
62Ø RETURN
7ØØ '*** Move cursor to different locati
on ***
71Ø PRINT@PX+PY*4Ø,CHR$(S(PX+PY*4Ø));
72Ø PX=X:PY=Y
73Ø RETURN
9ØØØ '*** Get button in B and coordinate
s in X and Y ***
9Ø1Ø CALL GM,,VARPTR(M(Ø))
9Ø2Ø B=M(Ø):X=M(2)/SC:Y=M(4)/SC
9Ø3Ø RETURN
91ØØ '*** Set maximum coordinate ranges
according to XM and YM, and initial coor
dinates according to X and Y ***
91Ø5 DIM M(4)
911Ø M(1)=XM*SC:M(2)=X*SC:M(3)=YM*SC:M(4
)=Y*SC
912Ø CALL SM,,VARPTR(M(1))
913Ø RETURN
92ØØ '*** Load Mouse Driver ***
92Ø5 RESTORE 93ØØ
921Ø MD=647Ø4-65536:FOR L=MD TO MD+165
922Ø READ D:POKE L,D
923Ø NEXT
924Ø RETURN
93ØØ DATA 195,2Ø3,11Ø,195,65,253,195
```

Continued

```
9305 DATA 214,252,195,230,252,0,0,0,0
9310 DATA 0,0,0,0,0,0,229,205,241,252
9315 DATA 210,215,252,225,17,204,252
9320 DATA 6,10,195,105,52,17,206,252
9325 DATA 6,8,195,66,37,205,65,253,205
9330 DATA 109,109,55,200,205,126,109
9335 DATA 216,254,8,210,238,252,50,204
9340 DATA 252,205,126,109,216,103,205
9345 DATA 126,109,216,47,60,111,17,206
9350 DATA 252,124,229,205,24,253,225
9355 DATA 125,6,0,237,19,19,167,250,49
9360 DATA 253,229,79,237,9,193,8,9,218
9365 DATA 60,253,96,105,43,195,60,253
9370 DATA 47,60,79,237,8,210,60,253,33
9375 DATA 0,0,217,19,19,175,201,175,50
9380 DATA 66,255,61,50,141,255,33,78
9385 DATA 5,55,205,166,110,62,84,205
9390 DATA 50,110,62,76,205,50,110,14
9395 DATA 5,205,28,83,205,109,109,194
9400 DATA 73,253,201
```

End of listing.

```
20 '* Mouse tester for 200 *
80 XM=40:YM=15:'X and Y maximum ranges
90 X=19:Y=7:'Initial X,Y coordinate
9210 MD=63574-65536:FOR L=MD TO MD+170
9300 DATA 195,181,135,195,215,248,195
9305 DATA 108,248,195,124,248,0,0,0,0
9310 DATA 0,0,0,0,0,0,229,205,135,248
9315 DATA 210,109,248,225,17,98,248,6
9320 DATA 10,195,186,65,17,100,248,6
9325 DATA 8,195,167,50,205,215,248,205
9330 DATA 8,133,55,200,205,25,133,216
9335 DATA 254,8,210,132,248,50,98,248
9340 DATA 205,25,133,216,103,205,25,133
9345 DATA 216,47,60,111,17,100,248,124
9350 DATA 229,205,174,248,225,125,6,0
9355 DATA 237,19,19,167,250,199,248,229
9360 DATA 79,237,9,193,8,9,218,210,248
9365 DATA 96,105,43,195,210,248,47,60
9370 DATA 79,237,8,210,210,248,33,0,0
9375 DATA 217,19,19,175,201,175,50,242
9380 DATA 252,111,103,34,69,239,61,50
9385 DATA 252,252,33,78,5,55,205,222
9390 DATA 134,62,84,205,67,134,62,76
9395 DATA 205,67,134,14,5,205,26,98,205
9400 DATA 8,133,194,228,248,201
```

Listing 2. For a Tandy 200 program, type in Listing 1, substituting these lines for their counterparts in Listing 1.

Parts List

Qty	Description	Radio Shack Catalog #
1	25-position male D-Subminiature	276-1547
1	25-position D-Subminiature connector hood	276-1549B
1	9-position male D-Subminiature	276-1537B
1	9-position female D-Subminiature	276-1538B
2	9-position D-Subminiature connector hoods	276-1539B
2	1/2 inch of wire	
3	6 inches of wire	
2	18 inches of wire	

Table 1. The parts needed make an adapter plug to connect a Logitech C7 or C9 mouse to your Tandy notebook computer. I used 6 feet of car speaker cable (cat no. 42-2431) for the wires.

```
;***********************************
;* Mouse driver for Logitech C7/C9 *
;***********************************

VER     EQU     200     ;Assemble M200
                        ;version
                        ;Change to 100
                        ;for M100.
        IF      VER=200
ACT232  EQU     86DEH
DEA232  EQU     87B5H
RCV232  EQU     8519H
MTR232  EQU     8508H
SND232  EQU     8643H
SERMASK EQU     FCFCH
XON_EN  EQU     FCF2H
CCSTRIP EQU     EF45H
        ENDIF
        IF      VER=100
ACT232  EQU     6EA6H
DEA232  EQU     6ECBH
RCV232  EQU     6D7EH
MTR232  EQU     6D6DH
SND232  EQU     6E32H
SERMASK EQU     FF8DH
XON_EN  EQU     FF42H
        ENDIF

XMAX    EQU     240     ;max x range
                        ;can be between
                        ;1 to 65535
YMAX    EQU     128     ;max y range
                        ;can be between
                        ;1 to 65535

YM      DW YMAX         ;max y range
Y       DW 0            ;current y
XM      DW XMAX         ;max x range
X       DW 0            ;current x

BUTTON  DB 0    ;button positions
UCLICK DB 0     ;just released buttons
DCLICK DB 0     ;just pressed buttons
;BUTTON,UCLICK,DCLICK's bits 2,1,0
;correspond to left, middle, right
;buttons, respectively

;=== Get mouse button & coordinate ===
;Purpose: Convert mouse input data into
;       coordinate location and button
;       positions.
;       Before calling this subroutine,
;       mouse must be initialized by
;       calling ACT_MOUSE
;Input:
;       X- previous x coordinate
;       Y- previous y coordinate
;       XM- maximum x range
;       YM- maximum y range
;Output:
;       Carry flag is set if no change
```

continued

Listing 3. The actual assembly-language mouse "driver," loaded and called by the program shown in either Listing 1 or Listing 2. It's written in the faster machine language because BASIC is too slow.

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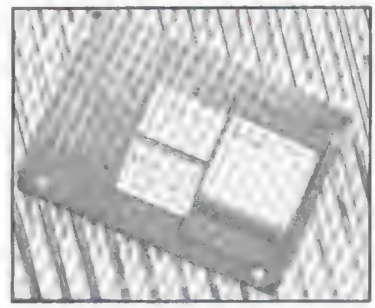

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```
;       in either button status or
;       coordinate,
;        else it's clear, and:
;       X- new x coordinate
;       Y- new y corrdinate
;       BUTTON- current button position
;       UCLICK- buttons clicked by
;               releasing
;       DCLICK- buttons clicked by
;               pressing down

LOCATE_MOUSE:
;get button position data
        CALL    MTR232
        STC
        RZ
        CALL    READ_MOUSE
        CALL    GET_CLICK ;update click
;get x travel data
        CALL    READ_MOUSE
        MOV     H,A
;get y travel data
        CALL    READ_MOUSE
        CMA
        INR     A
        MOV     L,A

;convert travel data into coordinates
        PUSH    H
        LXI     D,YM
        MOV     A,L
        CALL    CONVERT ;update X
        POP     A
        CALL    CONVERT ;update Y
        ANA     A       ;clear carry
        RET


;----- Convert -----
;Purpose: Decode travel data and update
;       a coordinate accordingly
;Input:
;       A- travel data
;       DE- pointer to coordinate data
;Output:
;       coordinate updated,
;       DE- incremented by 4(point to
;       next coordinate data)

CONVERT:
        ANA     A       ;which way?
        JP      POSDIR  ;positive
;negative direction-
; subtract from previous coordinate
        INX     D
        INX     D
        CMA
        INR     A
        MOV     C,A
        MVI     B,Ø
        LHLI            ;previous
        DSUB    B       ;subtract
;check if result coordinate is less
;than zero
```

Continued

```
        JNC     L2      ;no
;yes- don't go below zero
        LXI     H,Ø
L2      SHLI
        INX     D
        INX     D
        RET

;movement in positive direction-
;add to previous coordinate
POSDIR: LHLI            ;max range
        PUSH    H
        INX     D
        INX     D
        LHLI            ;prev coord
        MOV     C,A     ;add to prev
        MVI     B,Ø
        DAD     B
;check if result coordinate is
;out of range
        POP     B
        DSUB    B
        DAD     B
        JC      L3      ;no
;yes- limit to max
        MOV     H,B
        MOV     L,C
        DCX     H
L3      SHLI
        INX     D
        INX     D
        RET


;--- Get button clicks ---
;Purpose: Monitor clicking of buttons
;Input: BUTTON- current button position
;       BUTTON+1 - previous position
;Output:
;       BUTTON+1 has current position
;       UCLICK- buttons clicked by
;       releasing
;       DCLICK- buttons clicked by
;       pressing down
GET_CLICK:
        LXI     H.BUTTON
        MOV     B,M     ;previous
        MOV     M,A
        MOV     C,A
        XRA     B
        ANA     B
        INX     H
        MOV     M,A     ;up click
        MOV     A,C
        XRA     B
        ANA     C
        INX     H
        MOV     M,A     ;down click
        RET


;--- Activate Mouse ---
ACT_MOUSE:

;Set serial port Stat to 58N1DNN
        XRA     A
        STA     XON_EN
        MOV     L,A
        MOV     H,A
        SHLD    CCSTRIP
        MVI     A,FFH
        STA     SERMASK
AM1     LXI     H,Ø54EH
        STC
        CALL    ACT232

;initialize mouse
        MVI     A,'T'
        CALL    SND232
        MVI     A,'L'
        CALL    SND232
        RET


;--- Deactivate Mouse ---
DEACT_MOUSE:
        JMP     DEA232


;--- Read Mouse Data ---
READ_MOUSE:
        JMP     RCV232
```

End of listing

After constructing the cable, plug in the mouse and test it to see if it works by using the test program in Listing 1 or 2. Listing 1 is for the Model 100 or 102, and Listing 2 is for the 200. When you move the mouse, the cursor should move accordingly, and the three buttons on the screen light as you click them.

HOW IT WORKS

GOSUB 9200 loads the mouse driver into the alternate LCD screen buffer memory. Since this memory is in the area above *MAXRAM*, it does not interfere with other machine-language programs you may have loaded in the *HIMEM* area. The driver must be in machine language because *BASIC* is just too slow for it.

GOSUB 9100 sets up the maximum screen width and height and the initial coordinates. Values for maximum x,y and initial x,y must be specified in *XM*, *YM*, *X*, and *Y* variables, respectively, before *GOSUB*ing to 9100. Because of the way the *M* array variable interacts with the machine language mouse driver, you must declare it as integer type, by using *DEFINT* statement, as in line 50.

GOSUB 9000 gets the mouse's button position and its x and y coordinate in *B*, *X*, and *Y*. *B* will be 0 if you are not pressing any buttons, and 1 to 7 if you are pressing one or more buttons. Button value 1 corresponds to the right, 2 to the middle, and 4 to the left button. Add the values to know what combinations of you have pressed. For example, if you press all three of them at once, *B* would be 7 (1+2+4). Notice the use of *SC* that determines the movement sensitivity of the mouse. The larger value means less sensitivity. It is 8 in the test program, which means that the cursor moves 1 dot while the mouse moves 8 dots.

If you want to create your own program using the mouse, the assembly language source code here (Listing 3) for a sample mouse driver should help. The *JMP* instructions at the beginning are for interfacing with *BASIC*. The main routines are the mouse driver and mouse I/O. If you use these routines in your own machine-language program, at the be-

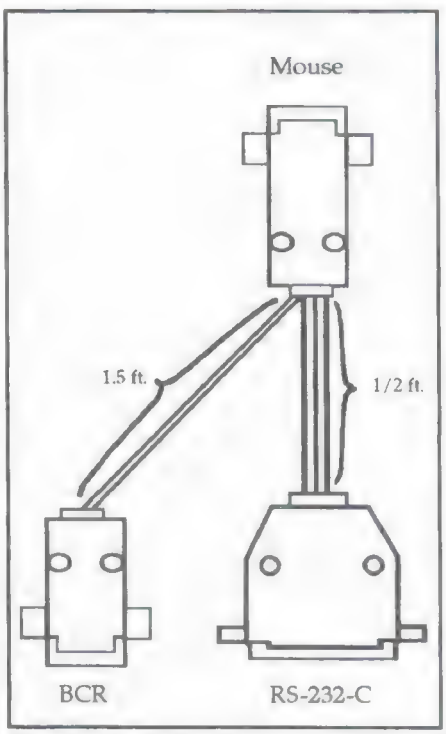

Figure 1A. The relative distances between the three connectors for your Tandy mouse system.

ginning of the program call *ACT_MOUSE*. Then, calling *LOCATE_MOUSE* of the mouse driver returns the current location of the mouse in *X* and *Y*, and the position of the three buttons in *BUTTON*. Left, middle, and right buttons correspond to bits 2, 1, and 0, respectively. The *X* and *Y* range are set by *XM* and *YM*, limited to 65535 maximum. When exiting, call *DEACT_MOUSE*.

If you have questions, problems, or whatever, that I might able to assist with, I can be reached at CompuServe, ID# 73327,1653.

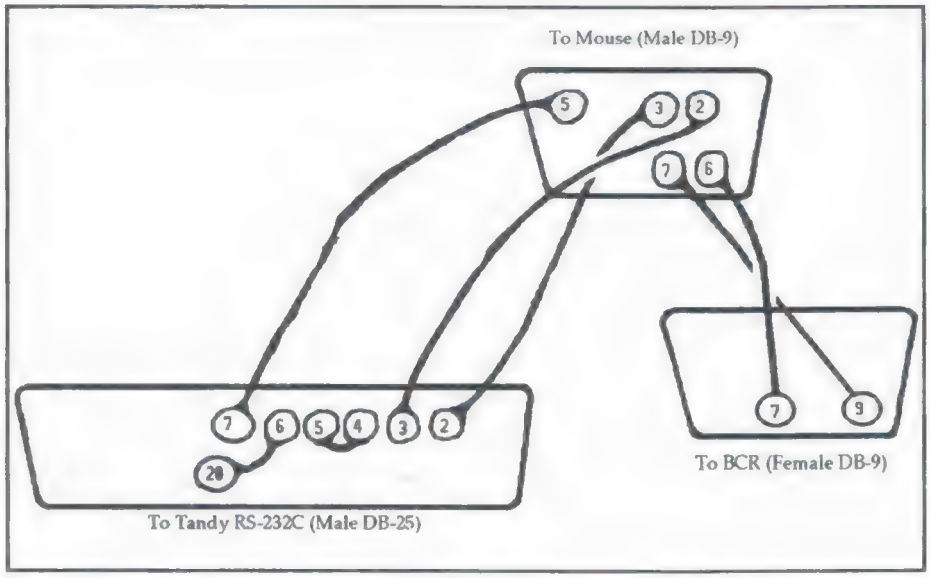

Figure 1B. Use the connections shown above to wire a connector that hooks you up to a mouse through your RS-232 port.

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COMPATIBILITY: Tandy 100/102 and Tandy 200.

LILITH: A Commercial Data Encryption Program

Create your-eyes-only security for Model 100 text files.

by Bob Scott

Laptop computers are a boon to traveling professionals. But for those with closely guarded secrets, security for files transported on laptops never seems adequate. An alternative such as exchanging data privately through an electronic message service like CompuServe is certainly convenient, but the absolute confidentiality of communications is far from guaranteed. *LILITH*, a data encryption program for the Model 100/102 and compatibles, offers one potential solution to this security problem.

To decide whether this program is for you, first consider whether you *need* data encryption. Do you really care if somebody gets to the data in your machine? Take my Model 100 for example. It typically contains some half-baked *BASIC* development code, a couple of personal letters, and a seriously outdated *ADRS .DO* file. I am not really a candidate for any James Bond ciphering exotica.

On the other hand, if you would be more concerned about losing the *data* in your laptop than losing the machine, you are probably in need of some spy stuff. Examples of this kind of data include

- Information that could send you to jail (just kidding!);
- Data that could expose you to litigation if compromised (e.g., client data you are obligated to protect);
- Items that could endanger your business if lost (bid proposals, etc.);
- Sensitive personal data (credit card numbers, steamy memoirs, etc.);
- Any telecommunications texts that involve the above items.

Based on this evaluation, if you decide you need data encryption, you then should decide what system is right for you. Several factors come into play, for example:

Security: With one exception, no unbreakable cipher exists. Cipher systems range from trivial (such as the popular puzzle "cryptograms") to extremely secure (military systems). Your selection should be based on the threat you perceive your data to be under. If you just want to confound file browsers, a simple cipher scheme should work fine. But if you think the KGB is after your *TSECRT.DO* file, you may need some heavier artillery.

Speed: All else being equal, the security of a system usually varies inversely with the speed. Faster programs are less of an inconvenience, and you'll more likely use them.

Transportability: If you communicate from, say, a Model 100 to a Macintosh, you'd obviously need a compatible program for each machine.

You can take many other factors into account as well. And you'll find no single solution to a commercial or personal data encryption requirement. The smart buyer either studies up on the field (many data security texts and software reviews are available) or hires a qualified consultant to provide advice.

DESCRIPTION

LILITH is a proprietary file encryption package produced by CRYPTEK. The program is written in *BASIC* for the Model 100/102 and compatibles. It uses no machine-specific functions, so it is likely to work well on the Model 200 as well.

LILITH processes only text (*.DO*) files in RAM. The resulting output (cipher) file is in upper-case ASCII hexadecimal format. Although ideal for sending via electronic mail, this results in an encrypted file about twice as large as the source file. On a 32K Model 100, *LILITH* can encrypt a file of only about 8K in length before running out of room for the source file, output file, and program. The program is slightly over 4,100 bytes in size.

LILITH is written entirely in *BASIC* and should create no conflicts with machine language DOS's or other special programs.

OPERATION

Operation of the program is straightforward. The user supplies an eight-number key (with each number varying between 1 and 255), types the input and output file names, and selects file encryption or decryption.

The program then proceeds with its task, signaling completion with a beep tone. As mentioned, the resulting cipher text file is in upper-case ASCII hex (similar to the format used by the Borland SuperKey encryption program for PC compatibles).

Since the only characters used are the numbers 0 through 9 and the hex letters A through F, the file should be acceptable for transmission over any electronic medium, including telex.

PERFORMANCE

Speed? This is a real problem. Running on a Model 102, *LILITH* processed data for encryption for me at a glacial 2.33 seconds per character. A 2,000-byte file took one hour and seventeen minutes to encipher. In its current incarnation, *LILITH* is simply too slow. It is only of value to the most disciplined user who needs a high level of security.

And what about security? One of the hazards of buying a cipher program is that only the author really knows how well the program works—if even he does. Although the encryption algorithm used in *LILITH* is proprietary, I can report that it is exceedingly complex. It

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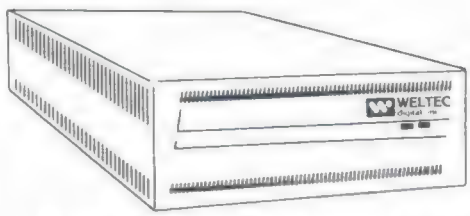

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seems to indicate the author has done his homework.

Key length is one elementary measure of system security, and *LILITH* is certainly secure from an exhaustive trial of all the possible keys. The cipher demands eight separate eight-bit numbers as a key, and rejects any that are cryptographically "weak."

To give you a feel for what this means, consider a potential adversary who could try, say, one different key every second. In a mere 5.8 billion centuries, you'd be had. Actually, the odds are fifty-fifty that he'd hit the right key in less than 2.9 billion centuries, but I'd still not let that keep you up at night.

As this points out, successive key trial is not a productive way to break a cipher. Practical attacks usually focus on flaws in the cipher algorithms that make it mathematically weak. (If you're interested in how this is done, I recommend any of the books listed in the bibliography for further reading on the topic.)

During my tests, *LILITH* happily digested any text file I threw at it, both for enciphering and deciphering. The only shortcoming I noted is that the deciphering routine usually adds a few garbage characters to the end of the decoded text file. This not a serious problem; the characters are easy to delete.

Since the program is written entirely in *BASIC*, you may wonder if it runs on other machines. The answer is a tentative no. Running under *QuickBASIC*, *LILITH* produced different results than it did when run on the Model 102. In addition, encrypted files didn't decrypt properly. I believe the program is working on the edge of the machine's floating point accuracy and that it's not readily transportable. The author may have compatible programs available for other machines; it would be worth a call if you are interested.

Error sensitivity is moderate. One error in the cipher file (such as taking a "hit" during a download) results in several sequential errors in the deciphered text file. Assuming that a character hasn't been added or dropped, however, the program resynchronizes within a few characters and again provides correct output.

CONCLUSIONS

The slowness of *LILITH* is a significant drawback. I think I could almost beat the program's performance using a manual (i.e. pencil and paper) system. A 2,000-byte file that would take *LILITH* over an hour and a quarter to process can be handled by a public domain IBM-PC cipher program (*MERLIN*) in 45 seconds flat. *MERLIN* uses the very complex and secure Data Encryption Standard (DES) coding scheme.

One possible solution to this slowness problem: simplify the logic of *LILITH*, make any possible optimizations to the program, then compile it and burn it into a ROM. Besides speed, I think the user of such a program would appreciate having it handy in ROM—safe from tampering and taking up no precious RAM space (also increasing the size of RAM files it could handle). Adding disk I/O would also be a considerable advantage when dealing with large documents.

In the meantime, if you don't think the KGB is after you, you may consider public domain alternatives. The Model 100 SIG on CompuServe has several simpler enciphering programs available. Although they don't compare in complexity to *LILITH*, they *are* much faster, and just as easy to use.

Bob Scott is an electrical engineer with the US Navy. He currently lives and works in San Juan, Puerto Rico.

Bibliography

The Codebreakers by David Kahn. 1967, Macmillan.

Ciphers, Codes and Computers by Bruce Bosworth. 1982, Hayden.

Proceedings of the IEEE, May 1988. IEEE Press.

Manufacturer's Specifications

Lilith—$79.95
Data encryption software

CRYPTEK
633 Post St., Suite 193
San Francisco, CA 94109

COMPATIBILITY: Tandy 1400

The Falcon, the Flightstick, and the Top Flight Game Port

Put more joy in flying, without fear.

by Bob Liddil

Flight simulation programs are among the best, most complex, and enjoyable of the graphics games available for the 1400 series MS-DOS Tandy portables. Unfortunately, some obstacles stand between a would-be 1400 pilot and aerial bliss. For example: choosing the proper software, the correct joystick, and then discovering that the joystick does not attach readily to the 1400FD? What's a captain to do? How could I get my Tandy laptop to take me into the skies? Well, read on, pilot, and revelations will be forthcoming.

First things first. The 1400FD has no joystick port, which meant I have to install one. Adtron's Top Flight game port turned out to be just what the flight surgeon recommended. This compact little job plugs right into the expansion slot of my 1400. It took a little wiggle to get it in and the screws didn't line up exactly, but I did get one screw tightened and that was enough to allow me to batten down the cover when there's no stick installed. At $95, it was a good buy, and it later proved to be true to its claim of universal compatibility with IBM games.

Next I needed a joystick. Enter CH Products Flightstick, advertised as being specifically for use with air flight simulation programs, though not limited to them. This was borne out by the success I had had with the robot shoot-em-up program *THEXIDER*, which I played for two weeks until the flight program arrived.

Finally, UPS brought what I was waiting for. Spectrum Holobyte's master level F-16 simulator, *FALCON*, arrived, sending one future sky warrior (me) into scurries of mad preparation for combat. It proved worth the wait. Clad in a multicolored jacket with enticing pictures suggesting the rip-roaring combat sequences within, this program was not disappointing. Once inside, I encountered a 132-page documentation book resplendent with illustrations on all phases of flying the Falcon. I promptly put that aside and loaded the program up.

Photo 1. With the CH Products Flightstick (background) and the Top Flight Game Port (foreground), you can now play joystick-oriented games on your Tandy 1400.

UP, UP AND ... DOWN

From the beginning I discovered two givens: flying an F-16 with a keyboard is like water skiing on ice skates (not impossible, but bloody difficult), and maybe putting aside the instruction book was not the best idea. Still, I was determined to FLY, then and there! So, armed with some basic knowledge of how computer jets fly, I wound up the engine, scooted down the runway, crashed and burned. Four takeoffs, four crashes later, I decided to go ahead and plug the Flightstick into the Top Flight port and see if things improved. They did.

Flightstick engaged, I still crashed, but at least I got the Falcon into the air before I did. Finally, I gave in and opened the instruction book, subsequently discovering that the F-16 flies much better with the speed flaps, speed brakes, and wheels in the "up" position. Right. And with the throttle set at 100 percent rather than 60 percent, my plane and I were destined for the clouds. So much for flying with the book closed.

The Flightstick "control surface actuator" is adjustable. On the sides of the base of the handle, thumbwheels perform different control surface fine tuning functions. I used these to trim the Falcon in level flight after releasing the autopilot (and after several harrowing wing-over-wing power dives). The stick is returned to mechanical center by simply releasing it from being gripped. Trim then takes place by spinning the wheels and observing the results on the screen.

Two good pieces of advice: Don't try this at low altitude, and do get the stick in trim before enemy jets arrive.

The Falcon, the Flightstick, and my hand became as one almost immediately. I found the stick responsive to slight or subtle touches. It's sleek. It fits comfortably in the hand. The firing buttons are realistically placed. And it's sturdy. Diving away from enemy aircraft—once I mastered staying in the air at all—I did not crush it in my excitement or wrench the handle out of its socket (as I have accidently done with other, lesser and unnamed joysticks.)

So after gaining considerable confidence (as in not crashing for five consecutive minutes), I decided to try a few complex movements coincidental to three enemy aircraft popping up in formation on my *six* (pilot lingo for tail). Snug in my hand, the Flightstick allowed me to bob and weave like Tom Cruise at Top Gun school. And like that erstwhile pilot of the silver screen, I got bounced and blown out of the sky by the three simulatronic bad dudes dogging my afterburner.

I ejected from the doomed Falcon and parachuted to safety, Flightstick in hand, ready to fight again (if only my commanding officer will give me another ten-million dollar plane. And if he won't—then I'll just reboot the drive, ha!

Manufacturers' Specifications

Top Flight Game Port—$95.00

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Gilbert, AZ 85234
(602) 940-0060

CH Products Flightstick—$74.95

CH Products
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FALCON—$29.95

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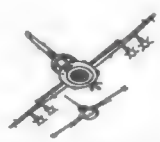
JOY IN MUDVILLE

My overall conclusions from this experience run the gamut from joy to enthusiasm to excitement. *FALCON* is delightfully multifaceted and mind-grindingly complex at once, leaving me, the player, satisfied and emotionally exhausted from playing. By no means is it merely a "shoot-em-up" kind of mindless twitch game. Serious strategy and attention to detail are required for success here. That you still have to go to the keyboard for afterburner, flaps, wheels, throttle and the like intrigues rather than inconveniences. The Top Flight Game Port could have been less scary in its installation, but with a little bend here and a wiggle there, it fit. So what the heck. How precise do things need to be? The Flightstick was the icing on the cake. It was a great tool to use and enhanced the game considerably. Overall, this triple-threat combination and its intrepid pilot will be protecting New Hampshire skies for years to come.

Now if I can just figure out how to land. ...



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Inside the Tandy 600
(Part 3 of 3 Parts)

Part 3 puts the parts together

by Stevie A. Stark

In the first two articles in this series I looked closely at some of the system components found in the Model 600. In this, my last article on the subject, I'll integrate into one big picture everything that has been covered previously. That is to say, I'll look at the Model 600 as a system.

THE MODEL 600 AS A WHOLE

Computers basically are a collection of circuits linked together with a central processor that controls the chain of events to make the computer do any useful work. Figure 1 is the block diagram of the Model 600. Looking at this diagram, you can identify the subsystems covered here to date.

The CPU is connected to all the memory and I/O subsystems through the *system bus*. The system bus is made up of the address, data, and control buses. It is through the system bus that the CPU can communicate with any part of the system. The smaller lines with the arrows are the lines the subsystem needs from the system bus to operate. While I won't specify what signals each subsystem needs, I will recap the subsystems and include explanations for some not yet covered.

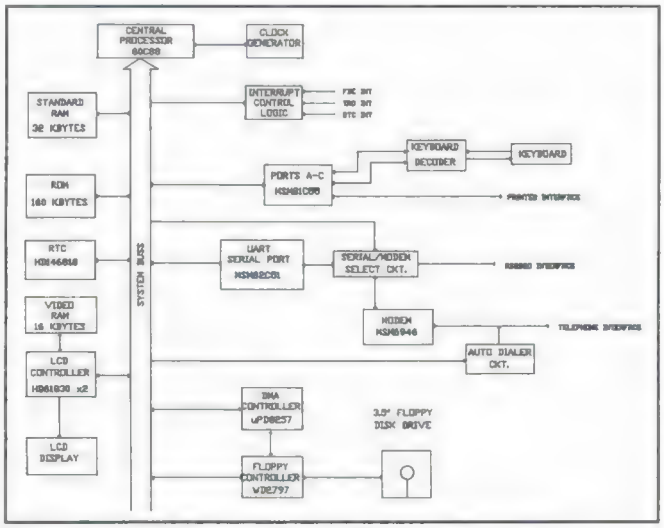

Figure 1. A block diagram of a Tandy 600.

SYSTEM OVERVIEW

As you already know, the CPU is the one thing that makes our Model 600 possible, but it needs a lot of help. It cannot generate its own clock signals that it needs to operate, so a clock generator has been included to do just that. From a system standpoint, the clock generator is *transparent*, meaning it has no interaction with anything else in the system. The memory is pretty much as previously discussed: 32 kilobytes of SRAM (static RAM) and 160K of ROM (read-only memory). It is shown (in the first two parts of this series) interfacing to the system bus as are the LCD controller, serial port (UART), and the DMA-floppy disk controllers.

Notice the two items on the block diagram I have not talked about yet, the real-time clock (RTC) and the interrupt control circuitry. The *real time clock* is exactly what its name suggests, a clock circuit that keeps track of year, date, and time, which the CPU can access anytime it wants. The *interrupt control circuitry* can handle three kinds of interrupts, interrupts from the floppy disk controller (FDC), interrupts from the serial or modem circuits (TRC), and RTC interrupts. Although the Model 600 uses these interrupts extensively, I'll keep this introductory.

SYSTEM OPERATION

Let's consider several of the most used operations that occur in the Model 600 to get the job done. As you read through these operations, try to visualize how the computer might integrate them into a program.

Scenario 1: You type data from the keyboard and the program stores it in memory until you type an @ symbol, at which time the program stops and saves the data to disk.

First, the CPU continually reads the 81C55, waiting for a valid key depression from the keyboard. It supplies a code to the 81C55 that represents one of the valid keys A-Z or a number. The 81C55 in turn supplies this code to the keyboard decoder, which scans the key associated with that code and returns a status bit to the 81C55. The CPU reads this status bit out of the 81C55. If the status bit is true, the CPU stores the ASCII code (an indusry-wide, agreed-upon configuration for representing characters) for that key in memory. If the CPU reads a false status bit, it goes to the next key and repeats the process.

When the @ key reads true (meaning you've pressed the @ key), the CPU stops reading the keyboard and notifies the floppy controller that it wants the data entered from the keyboard to be stored on

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disk. The CPU furnishes the floppy controller with the starting and ending addresses of the data, as well as the file name to store the data under.

Once the floppy controller has all the necessary information, it tells the DMA controller that it needs to transfer memory. The DMA controller makes a bus request to the CPU so that the CPU will release the bus. When the CPU releases the bus it tells the DMA controller that it did so. At this point, the DMA controller takes care of all addressing and allows the floppy controller to pull the data out of memory and write it to the drive. And so ends scenario 1.

Scenario 2: For this one, you are going to read the file you have previously saved to disk and send it out the printer port to your printer.

First, the program has to read the data file off the disk drive and store it in memory. To do this, the CPU informs the floppy controller that it wants to read a file. It provides the floppy controller with the name of the file it wants and tells it where to put it in memory. At this time, the floppy controller informs the DMA controller of the impending transaction. The DMA controller gains access to the bus and provides all addressing functions for the floppy controller.

The floppy controller reads the data off the disk and stores it in memory. When this is done, the DMA controller relinquishes control of the bus, and the CPU takes over. The CPU reads the data out of memory and sends it to the 81C55, your printer port. When the data has been written to the printer port, the CPU activates a control line on the 81C55, which sends the data from the printer port into the printer, causing it to be printed. This process is repeated until all the data is printed.

```
40  CLS
50  PRINT "EDIT FILE - E"
60  PRINT "READ FILE - R"
70  PRINT "PRINT FILE - P"
80  INPUT C$
90  IF C$="E" THEN 200 ELSE 100
100 IF C$="R" THEN 300 ELSE 110
110 IF C$="P" THEN 400 ELSE 40
200 OPEN "A:TEST.DAT" FOR OUTPUT AS #1
210 INPUT B$
220 PRINT#1,B$
230 IF B$="@" THEN 240 ELSE 210
240 CLOSE#1
250 GOTO 40
300 CLS
310 OPEN "A:TEST.DAT" FOR INPUT AS #1
320 INPUT#1,D$
330 PRINT D$
340 IF D$="@" THEN 350 ELSE 320
350 CLOSE#1
351 FOR N=1 TO 4000
352 NEXT N
360 GOTO 40
400 OPEN "A:TEST.DAT" FOR INPUT AS #1
410 INPUT#1,D$
420 LPRINT D$
430 IF D$="@" THEN 440 ELSE 410
440 CLOSE#1
450 GOTO 40
```

Figure 2. A short, primitive text editor written in BASIC. *This program simply creates files and reads to and writes from disks.*

THE FINAL EXAM

Figure 2 shows a *BASIC* program, a very simple text editor with three functions. It can create a file on disk, read a file from disk, and print a file from disk. Keep in mind that each *BASIC* statement contains many machine-level instructions for the CPU. So several CPU operations occur with the execution of one *BASIC* statement.

THE COMMAND INTERPRETER

Lines 10 through 30 are *remark* statements, comments you write to yourself about the code, which have no effect on the operation of the program or the computer. The program actually starts executing at line 40. When the CPU encounters the *CLS* statement, the CPU sends a clear screen command out the system bus to the display controllers. This causes the display controllers to turn off or erase all pixel information stored in video RAM. This in turn causes the display to go blank on the next display update cycle (the display stays clear).

Lines 50 through 70 are print statements, which cause the text string enclosed in quotation marks to be printed on the display. The CPU sends each ASCII character from the print statement to the video controller. The video controller loads this information in video RAM, which displays it. Note that a carriage return follows the text associated with a print statement. Execution of lines 50 through 70 causes the following to be displayed on the screen:

EDIT FILE - E
READ FILE - R
PRINT FILE - P

This prompts for the next statement. The statement *INPUT C$* asks you which function you want. When the CPU sees this statement, it starts a continuous keyboard scan; it reads the 81C55 for a key-

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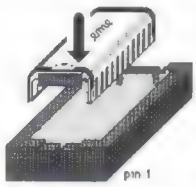

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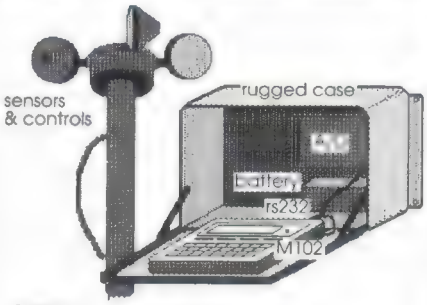

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board status signal until you press a key. When you do, the CPU picks it up and stores it in memory in a location that the CPU has allocated for the variable *C$*.

Lines 90 through 100 are test statements that allow the CPU to make a decision based on your response to the input query. *IF* statements tell the CPU to test variables against constant values (does *C$* equal the character *E*?). If the test condition is true, the CPU redirects program execution to the line number indicated by the *THEN* statement (line 200). If it is not true, execution goes to the line number indicated in the *ELSE* statement (line 100). This is how the CPU determines what function to do.

If in line 80 you enter an *E* on the keyboard, line 90 redirects program execution to line 200. Lines 200 through 240 open a file on disk and let you type data, immediately stored in the file *TEST.DAT* on disk.

Here's how it works: The *OPEN* statement forces the CPU to send a command to the floppy disk controller to open a file, in this case *TEST.DAT*. The rest of the statement tells the CPU to tell the floppy controller that data is to go into the file and that it is stored in a section of memory labeled file buffer #1. From here, the floppy controller lets the DMA controller know where to look for the data.

Once all this occurs, the *OPEN* statement is finished and the CPU starts executing code associated with line 210, the *INPUT* statement. It causes the CPU to read the keyboard again until it gets a valid key depression to store in memory as the variable *B$*. This variable can be one long text string such as "The Model 600 hardware is not so mysterious after all." If you were to type all this here before pressing *ENTER*, the CPU would read it and store it in RAM as *B$*.

INSTRUCTION

The next line, *PRINT#1,B$* (line 220) instructs the CPU to signal the floppy controller to get the contents of *B$* and store it in *TEST.DAT*. Of course, the floppy controller tells the DMA controller to take over and coordinate the transfer. In line 230, the CPU tests the variable *B$* against the @ character, the end-of-file marker in this case. If you type an @, the program jumps to line 240, which causes the CPU to send the command to close the file to the floppy controller. The floppy controller closes the file and returns control to the CPU. If the CPU determines you haven't typed an @, it will go back to line 210 and wait for you to type more data.

READING THE FILE

When the CPU regains control after the floppy closes the file you've written to, it resumes program execution at line 250. This statement unconditionally redirects program execution to line 40. This puts you right back in the command input mode.

Instead of pressing *E*, this time you can press *R* for read. When you do this, the CPU determines that it should go to line 300 to resume program execution. Line 300 contains a *CLS* statement, clearing the display. Line 310 causes the CPU to tell the floppy controller to open the file *TEST.DAT* for input using file buffer #1. Line 320 tells the CPU to command the floppy controller to send the data stored in *TEST.DAT* to file buffer #1. The CPU then loads this data into memory as *D$*. Line 330 tells the CPU to get the data in *D$* and send it to the video controller, which prints it on the LCD screen.

The next statement, line 340, is a test statement (like line 230) that looks for the end of the file. If it is, the file *TEST.DAT* is closed in line 350. Lines 351 and 352 force the CPU to delay executing line 360, which returns to the menu.

I will let you figure out how the rest of the program works. It gives you a printed listing of the file *TEST.DAT*. You should be able to figure how this section of the program affects hardware. Hint: *LPRINT* causes the indicated variable to be directed to the printer.

CONCLUSION

As you can see, computer hardware is not as mysterious as you might have thought. It is really interesting once you get over the initial bias that most people generally have. Do not feel bad if you are not an expert after reading this article. I use computers every day in my work as an electronics engineer and have even designed a few, but I still don't consider myself an expert. There is always something new to learn. ✇

DEFUSR appears monthly to answer your questions about Tandy notebook computers.

Send your queries to: DEFUSR, PORTABLE 100,
P.O. Box 428, Peterborough, NH 03458-0428.
Please enclose a stamped, self-addressed envelope for our reply.

"RANDOM" ERRORS

Mr. Nugent, I would like to ask you about a problem which is the same or similar to one you mentioned in your review of *TS-RANDOM* in *PICO* magazine (July '87). You may recall mention of including with the article a listing to help error trapping in random access mode. I couldn't seem to find the listing and figured the typesetter left it out. I am still curious about the problem.

From time to time, I experiment a bit with the *FILER.BA* sample program (from the *TS-RANDOM* disk), but before long, an attempt to press *ENTER* after typing input data produces a lock-up. Pressing the *RESET* button activates the computer, but further attempts to input freeze the display.

Sometimes the problem presents itself in one or two of the P.G. Design 32K banks, but not in the third bank. A cold start is needed, and sometimes, a disk reformat.

I have ROM version 1.01. I wonder if the *FILER* program was modified in later versions in some way to make it viable. Also, there is the mystery of the missing listing from the *PICO* article. Is there any chance you might still have a copy of this?

I commend your efforts to be even-handed in product reviews, unfortunately not something universal.

Richard B. Heilman
Fruitland Park, CA

TS-RANDOM *ROM v1.01 has faulty disk error trapping, causing the symptoms you describe, though I don't know why your third bank seems unaffected. Version 1.02 corrected that problem but introduced one of its own: now the cold-start file recovery (via* CALL 911*) wouldn't work!*

My source at Traveling Software believes the last version of TS-RANDOM *to be v1.30. If you call their Technical Support Department at (206)483-8088, they may be able to locate the master v1.30 ROM and give you an RMA (return authorization) number so you can return your ROM for an upgrade.*

FILER.BA, *distributed on the* TS-RANDOM *disk, also had faulty disk error trapping, and my suggested corrections were indeed somehow omitted from the* PICO *review. I've fired up my ol' Model 4 and tried to find my original submission, but alas, no luck!*

-MN

I am not a programmer, so please be basic

TRY A FINANCE DATABASE

In your reply to "GREENHORN" on family financial accounting (DEFUSR, Dec. '89), as you say, the *Lucid* spreadsheet on *Super ROM* would work. But so would the database on *Super ROM*, or the database on *CRDFIL.ROM* (perhaps the easiest way to get up and running?), which was reviewed in the October '89 issue.

I prefer a database. I create two files using *T-Base* in the *Ultimate ROM* on my Tandy 200, one for debit items and another for credit items. When printed, I have a "T" Ledger account with debits on the left half of the sheet and credits on the right. I also designed a running balance account, full page width, in case I ever need it for a journal, checkbook, bills payable, etc.

Although the Input screen or Report can do a search, I usually search directly in the chosen file by using *F4* (*List*) followed by *F1* (*Find*). The search lists all records in the file with a particular name (e.g., rent, auto, heat) or all records in a single category when properly tagged (e.g., **E* for expense, **T* for tax, **N* for newspaper/magazine).

Model 100/102 owners could use this "find-all" function by renaming their data file as *NOTE.DO* and searching in *SCHEDL*, or by renaming it as *ADRS.DO* and searching in *ADDRSS*.

David Line
Missoula, MT

Thanks for another good idea! By the way, rather than rename their data files, Model 100/102 owners can duplicate the Tandy 200's F4 (List) *function with Bill "FULL POWER" Brandon's implementation of* FETCH!.BA *(NOT FOR BEGINNERS ONLY, May '89).*

-MN

FLOPPY.CO CONFLICT

I am having some problems with application of *FLOPPY.CO* and Tandy's *Executive Calendar* program. I am not a programmer, so please be basic.

When I load the *Calendar* program into RAM, it runs fine, but *FLOPPY.CO* will not then access from the main menu. From some of your advice to others, I suspect a *MAXRAM* conflict but have no idea how to correct the problem. Line 5 in *Calendar* specifies *CLEAR 4000, MAXRAM*. I have tried loading

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DEFUSR

Could we set HIMEM *lower than 59400? Yes. As long as* HIMEM *is set equal to or lower than the start of a .CO program, it won't complain.*

How about higher? Nope! If the HIMEM *drop ceiling is set higher than the start of a .CO program, the computer beeps to announce its displeasure and refuses to run the program.*

As you may have noticed, the HIMEM *drop ceiling is set by the last value in a* CLEAR *statement. And that's where* Calendar *is tripping you up. Line 5's* CLEAR 4000,MAXRAM *sets the drop ceiling all the way back up to the* MAXRAM *ceiling (address 62960), so when you go to run* FLOPPY.CO, *there's no high memory space set aside for it. That's why you must set* HIMEM *with the* CLEAR *statement before running* FLOPPY.

A note to programmers out there: Your program isn't the only one a user will own, so please try to make it "other-program-friendly." If Calendar *were more thoughtfully designed, it would note the existing* HIMEM *value upon entry and restore it upon exit. The very same* CLEAR *statement that would accomplish that could also free up the 4000 bytes of string space* Calendar *reserves (the* 4000 *in the* CLEAR *statement), and which, judging by its* HIMEM *behavior, it most likely never returns to the free memory pool.*

The *HIMEM* ceiling is set by the last value in a *CLEAR* statement. And that's where *Calendar* is tripping you up.

Now, James, as for cheap calculator programs, there are many. You'll find them in back issues of Portable 100, *on GEnie, CompuServe, and private bulletin boards. I can't recommend a specific one, because I've always opted for the pocket calculator. If I'm not mistaken,* Supera *(from Ultrasoft Innovations) has one built-in.*

We need and want the advertisers, but we appreciate your compliments on the "small town newspaper" feel. Just don't expect to see "High School Football Highlights" or "New Hampshire Farm Report," okay?

-MN

FLOPPY.CO before and after *Calendar* with no difference. Please help.

Secondly, is there a (cheap) program available which allows the Model 100 to be used like a pocket calculator? Being an enthusiast of Michael Daigle's "portable office" concept, it seems that carrying a calculator, when a computer is available, is redundant.

Thanks for the magazine. While others may complain about its size, my experience has been that increased size only means proportionately more advertising than editorial pages. While I am sure it would make your life easier, this reader enjoys the "small town newspaper" feel. I would never feel as confident asking a larger magazine basic questions.

James H. Lake
Whiteman AFB, MO

The most basic answer is to enter BASIC *and type* CLEAR 256,59400 *(and press* ENTER*) before running* FLOPPY.CO.

A slightly technical explanation will show why and can help you solve similar problems in the future:

Picture MAXRAM *as a "ceiling," the upper limit of usable memory. Now picture* HIMEM *as a "drop ceiling" which, like a real drop ceiling, you can set equal to or lower—but never higher—than the actual ceiling.*

Machine language programs like FLOPPY.CO *run in the space between the ceiling and the drop ceiling. The larger the program, the farther it extends downward from the ceiling (i.e., the lower it begins in memory), and the lower we must set the drop ceiling to protect it.*

Since FLOPPY.CO *begins at address 59400, that's where we set the drop ceiling. Typing* CLEAR 256,59400 *sets* HIMEM *to 59400.*

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List price is $29.95. For more information, contact Merritt Computer Products, Inc., 5565 Red Bird Center Drive, Suite 150, Dallas TX 75237 (214)339-0753. *Or circle #61 on your Reader Service Card.*

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Alpha Plastics Company offers laptop users an alternative to soft carrying cases with its newest case line called *VideoGuard*. VideoGuard cases have a ribbed ABS plastic shell construction. Shells are mounted on hardened aluminum frames that are black anodized and have red accent lines. Included in the design are lightweight molded handles, cold-rolled steel hinges and positive locking latches mounted in a steel console. Inside is convoluted foam and die-cut foam cubes, removable to make needed cavities of any size.

Although originally designed for video cameras, Alpha generated interest from the laptop market through mailings and telephone marketing. As a result of these efforts, VideoGuard cases are now available through all Sanyo laptop dealers as well as by direct order.

For more information, contact Alpha Plastics Company, 9315 Evergreen Blvd. NW, Coon Rapids, MN 55433 (612)786-6940. *Or circle #62 on your Reader Service Card.*

The super-sturdy VideoGuard *computer cases were originally designed with expensive cameras in mind.*

X-Tel for Tandy 100/102 and 200

Sigea Systems has released Version 2.2 of *X-Tel*, a 3.7K machine-language communications program that works with *TELCOM*.

It allows you to: 1) upload and download *.DO*, *.BA*, and *.CO* files with Xmodem error-checking protocol; 2) check an on-line file directory, including file size and free space; 3) use an on-line file delete to recover free space while connected to a host; 4) have on-line access to *TEXT* for preparing instant replies without disconnecting; 5) access *BASIC* on-line to run programs and manage disk files; 6) run *X-TEL* from high memory, releasing RAM space normally required to store machine code (*.CO*) files; 7) download machine-language or tokenized *BASIC* programs from CompuServe as easily as your mail; 8) and send error-free text, data, or program files from portable to mainframe or desktop computers—even over noisy intercontinental telephone lines!

Price of *X-TEL* is $60.00. For more information, contact Sigea Systems, Inc., 19 Pelham Road, Weston, MA 02193 (617)647-1098. *Or circle #64 on your Reader Service Card.*

Low Profile Gender Changer

Portable Computer International Corporation's new shield gender changers are the quick, inexpensive way to avoid modifying or replacing incompatible shield cables that won't match because both are the same gender.

These mini-size gender changers work with cables you already have. They are fully shielded with low impedance, and are less than one-fourth the size of other available gender changers.

PCIC offers male/male and female/female versions of nine-pin DB-9 ($12.00) and twenty-five pin DB-25 ($15.00) connectors. For more information, contact Portable Computing International Corporation, 145 Grove Street Extension, P.O. Box 428, Peterborough NH 03458-0428 (603)924-9455. *Or circle #60 on your Reader Service Card.*

New Node Utility from Paul Globman

Node Datapac users take note: a small, fast machine-language utility, *NREAD.CO*, is now available. *NREAD.CO* allows sequential access to ASCII *TEXT* files stored from a running *BASIC* program into the Node Datapac. The *TEXT* files *do not* have to be copied into M100/102/200 memory first. This gives a *BASIC* program access to much more data than could otherwise be stored in RAM.

Other Node utilities being developed will allow the removal of the Node ROM to permit the use of other ROM's while retaining the ability to transfer files between the Node Datapac and user RAM.

NREAD.CO is available for the Model 100/102 or Tandy 200 for $9.95 and is shipped on a PDD 100K diskette—or, for non-

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disk users, can be entered manually via keyboard.

To order *NREAD.CO*, send check or money order for $9.95 to Paul Globman, 9406 NW 48th Street, Sunrise, FL 33351 (Please specify computer model and medium). *Or circle #63 on your Reader Service Card.*

Telecommuter Classic

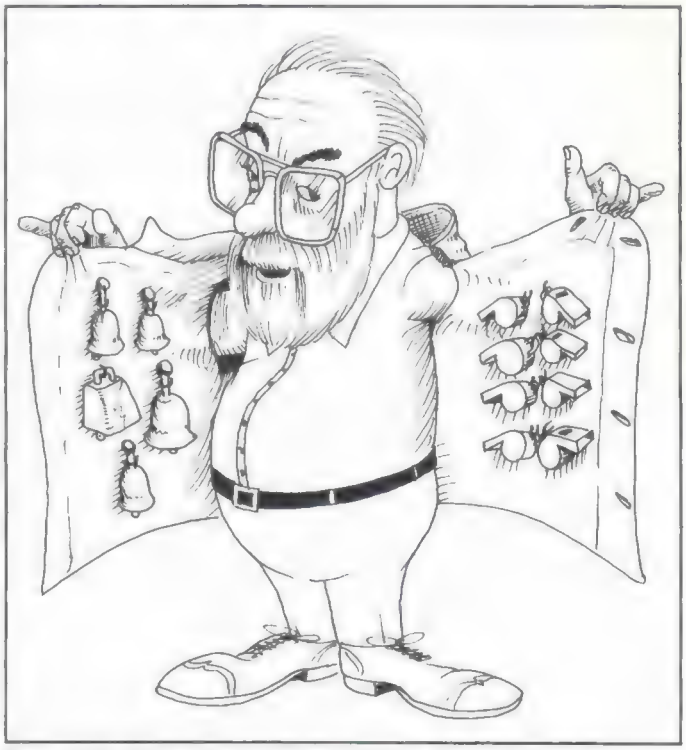
Sigea Systems has upgraded Telecommuter, an integrated word processing/communications/file transfer software product for MS-DOS desktop and portable computers, to *Telecommuter Classic*. Telecommuter's word processing and communications commands are based on those of the Model 100. There is no need to learn new software when you move up to an MS-DOS computer.

Telecommuter Classic has an address database with mail merge, form letters, and mailing labels. You can print an address book containing all or selected address records. The Model 100 script language has been extended to permit waiting for whole words in addition to single characters.

The address database lets you track clients with date and time stamping in a text file uniquely associated with each address record. Use *Telecommuter* to dial the telephone, let you take notes during the conversation, then create and print a customized form letter confirming the conversation.

Communications include Xmodem, VT100 terminal emulation and a macro capability to automate routine file transfer tasks. Word processing includes search-and-replace, file append, complete document formatting and pagination, and many other refinements.

Price of *Telecommuter Classic* is $200.00. For more information contact Sigea Systems, Inc., 19 Pelham Road, Weston, MA 02193 (617)647-1098. *Or circle #68 on your Reader Service Card.*



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See the review in the November 1989 issue!

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edited by Linda M. Tiernan

NEW PRODUCTS

32K Memory Expansion Kit for WP-2

MicroMime has released a 32K *memory expansion kit* for the new Tandy WP-2 word processor. The memory upgrade is a direct replacement for the Tandy "Internal 32K RAM Expansion," catalog no. 26-3932. Like the Tandy part, the memory expansion gives WP-2 owners 32K of extra document storage configured as a RAM disk.

A key feature of the MicroMime memory expansion product is that it uses the *exact same* chip that Tandy uses. Since the expansion memory is a user-installed item you are therefore installing the same part that Tandy uses.

MicroMime is also planning to introduce other products in the coming months for the WP-2 as well as for the Model 100 family of notebook computers.

Price of the WP-2 memory expansion chip is $29.00 (postpaid) or two for $50.00. For more information, contact MicroMime, P.O. Box 28181, Santa Ana, CA 92799. *Or circle #65 on your Reader Service Card.*

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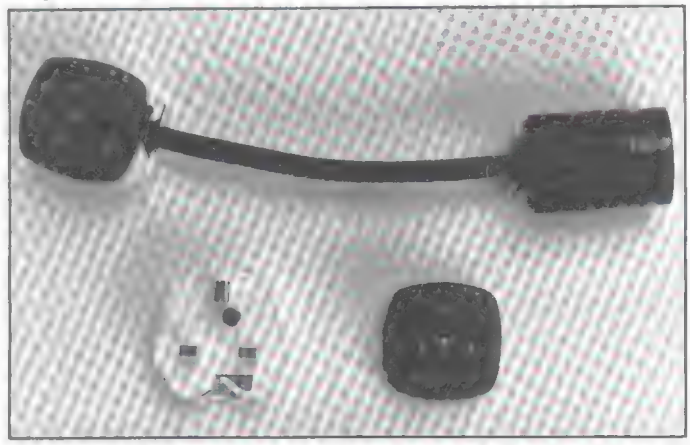

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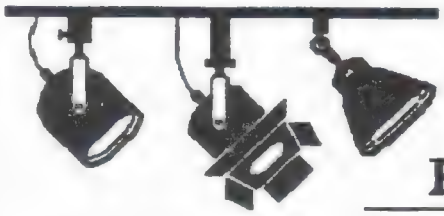
CRDFIL D/VI Version from Tony Anderson

Tony Anderson, producer of the *CRDFIL* database system for the Model 100/102, has announced that a version has been developed for use with the Tandy Disk/Video Interface. This allows full access to *CRDFIL* data files on disk as well as use of the D/VI screen for all *CRDFIL* functions. The program also uses the computer's LCD screen when the D/VI is not connected, allowing use in the same way as the non-D/VI version.

The *CRDFIL* program is distributed in the form of an EPROM (Electrically Programmed Read Only Memory Chip), which plugs into the computer's option ROM socket.

The D/VI version is offered at the same price as the original *CRDFIL.ROM*. Price is $59.95 for a standard EPROM, which plugs into external ROM storage devices (such as Traveling Software's Booster Pak or PG Design's SAFE ROM Pak), or $74.95 mounted in a carrier to fit the computer's option ROM socket (or the sockets in the PCSG/American Cryptronics 6-ROM Bank). Prices include first-class postage, a 65-page manual with 20 sample data file templates, and two free upgrades of the ROM chip in the event of major program changes. For more information, contact T.A.F.T., P.O. Box 60925, Reno, NV 89506. *Or circle #67 on your Reader Service Card.*



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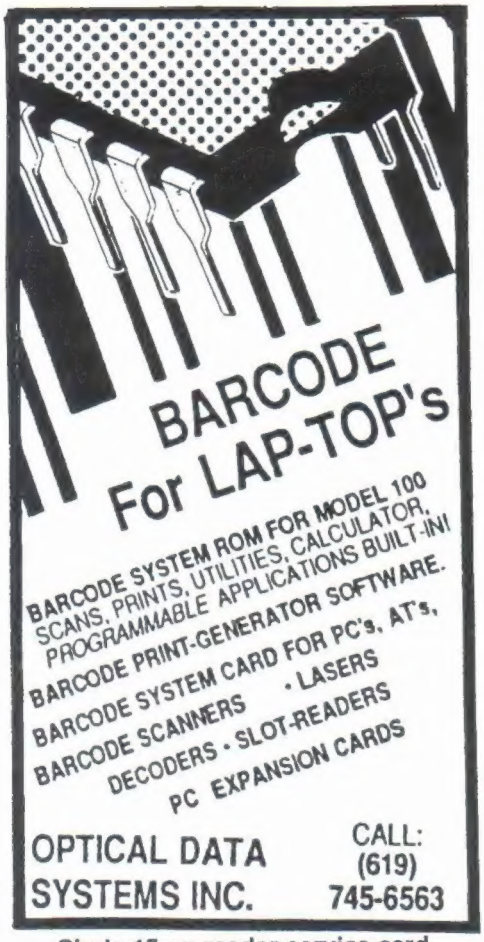

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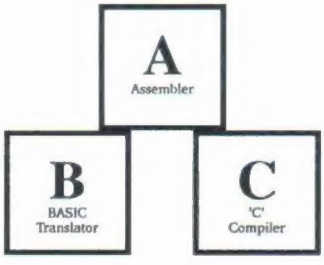

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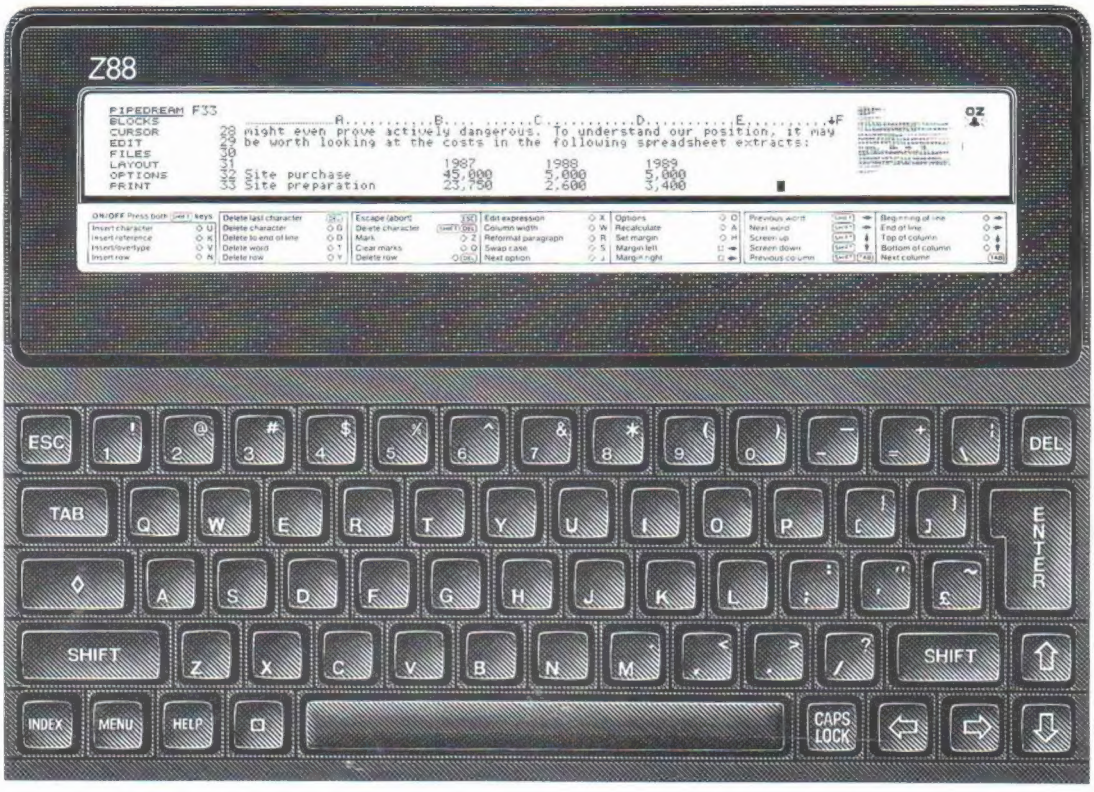

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